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CLADONIA ECMOCYNA IN NORTH AMERICA¹

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DURING the summer of 1951 important collections of lichens were made by Dr. I. Mackenzie Lamb in Alberta and British Columbia. In these collections the *Cladoniae* are well represented, and one of the most striking species among them is the controversial *C. ecmocyna* (Ach.) Nyl. Since this species has been confused with *C. gracilis* (L.) Willd., the writer has re-examined and subjected to microchemical tests a series of North American specimens in the Yale Herbarium which had been referred to *C. gracilis*. It soon became apparent that a number of these specimens, particularly among those from Alaska and the Rocky Mountain region, represented *C. ecmocyna*, rather than *C. gracilis*, and that the geographical range of *C. ecmocyna* in North America was more extensive than had been supposed. The specimens in question (with the exception of those from Greenland and the Aleutian Islands) are listed in the present report, following a history of the species and a discussion of its characteristic features.

CLADONIA ECMOCYNA (Ach.) Nyl. Notis. Sällsk. F. et Fl. Fennica Förhandl. 8: 176. 1866. *Cenomyce ecmocyna* Ach. in part, Lich. Univ. 549. 1810. *Cladonia gracilis* η. *elongata* *f. *ecmocyna* Vainio, Acta Soc. F. et Fl. Fennica 10: 469. 1894. *C. gracilis* var. *elongata* m. *ecmocyna* Vainio, *Ibid.* 14: 251. 1897. **C. elongata* f. *ecmocyna* Vainio, *Ibid.* 53: 93. 1922. *C. gracilis* var. *ecmocyna* Vainio in Zahlbruckner, Cat. Lich. Univ. 4: 547. 1927.

The history of *Cladonia ecmocyna* is much involved, and the claims of the species for recognition have been repeatedly questioned. Nylander, in his original account (1866, p. 176), merely

¹ Contribution from the Osborn Botanical Laboratory.

stated that "*Cl. ecmocyna* (Ach. pr. p.)" should be separated from *C. gracilis* because treatment with KOH stained the podetial cortex yellow. Although he cited no synonyms he obviously based his species on some component of *Cenomyce ecmocyna* Ach., as indicated in the above synonymy. In fact he soon assigned the combination *Cladonia ecmocyna* to Acharius (1867, p. LV) and listed under it a var. *macroceras* Ach., in spite of the fact that Acharius had not accepted *Cladonia* as a generic name in his publications. The original *Cenomyce ecmocyna* was defined in a broad sense and included a number of elements in addition to the species now known as *Cladonia gracilis* (L.) Willd. Lichenologists, however, have associated Nylander's species definitely with *C. gracilis*, either as a closely related species or as a synonym of one of its varieties.

According to Th. Fries, who was one of the first to comment on *Cladonia ecmocyna* (1871, p. 82), many specimens of *C. gracilis* are negative with KOH, but some specimens of *C. gracilis* "var. *macroceras*" (particularly in material from alpine or arctic localities) are stained more or less definitely yellow by this reagent; and he pointed out that such specimens had been distinguished as *C. ecmocyna* by Nylander. At the same time Fries implied that there were no sharp distinctions between KOH- and KOH+ specimens and that *C. ecmocyna*, therefore, was based on an inconstant character. Vainio, in 1880, reached similar conclusions (see 1894, p. 125) and stated that the younger parts of the podetia in *C. gracilis* were commonly stained yellow by KOH. Under *C. gracilis* η . *elongata*, however, he listed a f. *ecmocyna* (Nyl.) Vainio, as noted in the synonymy, without giving a description of this form. He supplied this three years later (1897, p. 251), when he characterized "var. *elongata* m. *ecmocyna* (Ach.)" as having glaucescent podetia, making no allusion to any color-change induced by KOH.

In 1908 Zopf reported on the lichen-substances produced by various species and varieties of *Cladonia* subgenus *Cenomyce* (Ach.) Th. Fr., using *Cenomyce* Ach. as a generic name. The results obtained by his chemical analyses of *Cenomyce gracilis* var. *chordalis* (Floerke) Schaer. and *C. gracilis* var. *elongata* (Jacq.) Vainio (under which he listed *Cenomyce ecmocyna* γ . *macroceras* Ach. as a synonym) are of special interest in their

bearing on Nylander's *Cladonia ecmocyna*. According to Zopf's account the material of var. *chordalis*, which Sandstede had collected in Oldenburg, was stained more or less definitely yellow by KOH and yet contained no atronorine, the substance usually responsible for this color-change. He therefore attributed the reaction to the presence of fumarprotocetraric acid. The material of var. *elongata*, on the other hand, which he had personally collected in the mountains of Tirol at elevations of 1300 m. or above, although similarly stained yellow by KOH, contained both atronorine and fumarprotocetraric acid. Zopf had thus demonstrated, as he supposed, a chemical distinction between var. *chordalis* and var. *elongata*, although he found no definite differences in the color-changes induced by KOH.

Scriba, a few years later (1913, p. 176), disagreed with both Vainio and Zopf in regard to these color-changes and maintained that there was a difference between the distinct yellow color appearing at once in *Cladonia ecmocyna* and the brown color (as he described it) appearing gradually in *C. gracilis*. He noted further that central proliferations of the podetia were not infrequent in *C. ecmocyna*, but exceedingly rare in *C. gracilis*. On the basis of these distinctions he expressed the opinion that *C. ecmocyna* might be recognized as a valid species, except for the fact that it could not always be distinguished from *C. gracilescens* Vainio (now commonly known as *C. lepidota* Nyl.). He therefore included *C. ecmocyna* under *C. gracilescens* as a synonym and listed a specimen from Korea under the latter name. According to Scriba's account the podetia in his European material of *C. ecmocyna* either bore cups or agreed morphologically with cupless forms of *C. gracilis* var. *chordalis*. He was less definite about his North American material, although he compared a specimen from Labrador with *C. gracilis* var. *dilatata* and implied that specimens from British Columbia, Montana, and Washington were similar.

Scriba made no allusion to Zopf's chemical studies, but Vainio was strongly influenced by them. In 1922 he stated definitely that *C. gracilis* var. *chordalis* contained fumarprotocetraric acid only (p. 91), but that **C. elongata* (which he raised to subspecific rank under *C. gracilis*) contained both fumarprotocetraric acid and atronorine (p. 93). He described the color-

change induced by KOH in var. *chordalis* as "luteo (demum obscuriore)" and that induced in **C. elongata* as "dilute flavescencia aut lutescentia," but the difference indicated by these phrases is less than the difference described by Scriba between *C. gracilis* and *C. ecmocyna*. As indicated in the synonymy Vainio listed a f. *ecmocyna* under **C. elongata* and still characterized it only by its glaucescent podetia.

Meanwhile Sandstede, in 1912 (p. 381), also influenced by Zopf's report, had raised *C. gracilis* var. *elongata* to specific rank, with *C. ecmocyna* as a synonym, and had listed atronorine and fumarprotocetraric acid as the characteristic lichen-substances of the species. Ten years later, however (1922, p. 207), he recognized *C. ecmocyna* as a distinct species, characterized by the same lichen-substances, and reduced *C. elongata* to varietal rank under *C. gracilis*. He thus implied that the true *C. gracilis* var. *elongata* contained no atronorine and that the so-called material of *Cenomyce gracilis* var. *elongata*, analyzed by Zopf, represented *C. ecmocyna* instead.

In 1928 Anders listed both *C. elongata* and *C. ecmocyna* as valid species, restricting their range in Central Europe to high altitudes. At the same time he emphasized the marked similarity of these species to each other. According to his statements the podetia of *C. elongata* are stained yellow by KOH in the younger parts, but remain unchanged in the older parts, whereas those of *C. ecmocyna* are stained intensely yellow throughout. Anders called attention also to the frequency of central proliferations in *C. ecmocyna* and added that the podetia were grayish green and lighter in color than those of *C. elongata*.

Sandstede, in 1931 (p. 364), again recognized *C. ecmocyna* but in 1938 (p. 66) threw doubts on its validity. After stating that Zopf's analysis of "var. *elongata*" had presumably been based on material of *C. ecmocyna*, he suggested that typical specimens of var. *elongata* should be tested for atronorine. Then, if these tests should yield positive results, the chemical distinction between *C. gracilis* and *C. ecmocyna* would break down, and the latter would have to be reduced to synonymy.

The tests suggested by Sandstede were soon made by Asahina, who reported upon them in 1943. They were based on eleven European specimens distributed by Sandstede in his *Cladoniae*

exsiccatae under the name *C. gracilis* var. *elongata*. In eight of these specimens Asahina obtained negative results but was able to demonstrate the presence of atronorine in three, Nos. 714, 1132, and 1133, which he transferred to *C. ecmocyna*. He obtained positive results also with Nos. 600, 954, 1255 and 1281 of Sandstede's exsiccatae, which had been distributed under the name *C. ecmocyna*. He thus proved definitely that there was a chemical distinction between the true *C. gracilis* var. *elongata* and *C. ecmocyna* and that Zopf had based his analysis of "var. *elongata*" on material of the latter species. It is to be recommended, therefore, in distinguishing *C. ecmocyna*, that emphasis should be laid on the presence of atronorine, rather than on the more or less variable color-changes induced by KOH. It may be added that six of the specimens of *C. ecmocyna* distributed by Sandstede came from Sweden and the seventh from a high altitude in Switzerland.

Most writers on North American lichens have ignored *C. ecmocyna*, except perhaps in synonymy, but Dahl, in a report on the macrolichens of South West Greenland (1950, p. 97), accepts the species without question and characterizes it, not only by the presence of atronorine, but also by its coarse podetia, with a smoother cortex than in *C. gracilis*. According to his account *C. gracilis* is represented in Greenland by var. *chordalis* only, and all the specimens from the island, which have been determined as var. *elongata*, should be referred to *C. ecmocyna* instead. He reports the species also from Central Europe, Scandinavia, Spitzbergen, Novaya Zemlya, Kamchatka, "America," and Patagonia, on the basis of specimens which he has personally examined. Dahl emphasizes the fact that in Greenland *C. gracilis* var. *chordalis* grows on rockfalls and lichen-heaths, but that *C. ecmocyna* prefers snow fields and bogs. The two species thus differ ecologically, at least in Greenland.

Aside from the presence of atronorine in *C. ecmocyna* there is really little to distinguish the species from *C. gracilis*, and the few slight differences noted in the literature are based on inconstant characters. The differences in the dimensions and color of the podetia, for example, and in the appearance of the podetial surface are caused largely by external factors and are therefore of little significance. The occurrence of central proliferations,

also, although emphasized by both Scriba and Anders, is much less frequent than they imply, and most specimens of *C. ecmocyna* lack such proliferations altogether. Even the range of variability in the two species is much the same, since some specimens of *C. ecmocyna* agree morphologically with *C. gracilis* var. *elongata*, others with *C. gracilis* var. *chordalis*, and still others with *C. gracilis* var. *dilatata*. The varieties of *C. gracilis* in their more typical development are clearly marked and amply distinct from one another; and yet some specimens of the species are less definite in their morphology and represent more or less intermediate forms. Similar, more or less indefinite, forms occur also in *C. ecmocyna*. On the whole the relation of *C. ecmocyna* to *C. gracilis* is much the same as that of *C. cryptochlorophaea* Asahina and *C. Grayi* Merrill to *C. chlorophaea* (Floerke) Spreng.

The geographical range of *C. ecmocyna* in North America, although duplicating that of *C. gracilis* to a certain extent, is more definitely northern and alpine, just as it is in Europe. In New England, for example, the only known station for *C. ecmocyna* is the summit of Mt. Katahdin in Maine, whereas specimens of *C. gracilis* have been collected from as far south as Connecticut.

The recognition of subordinate categories under *C. ecmocyna* was initiated by Nylander when he listed *C. ecmocyna* var. *macroceras* Ach. (1867, p. LV). Vainio, in 1894, referred this variety definitely to *C. gracilis* η . *elongata* as a synonym (p. 116), and it seems justifiable to retain the varietal name "*macroceras*" for specimens of *C. ecmocyna* which exhibit the morphological features of *C. gracilis* var. *elongata*.

In addition to var. *macroceras* Nylander recognized three forms of *C. ecmocyna*: f. *nigripes* and f. *contorquescens* in 1873 (see Norrlin, p. 319) and f. *gracilescens* in 1876 (see Norrlin, p. 13). According to Vainio (1894, p. 109) the original specimens of f. *nigripes* and f. *gracilescens* are referable to *C. gracilis* γ . *chordalis*, and the writer suggests retaining "*nigripes*" as a varietal name for specimens of *C. ecmocyna* with the morphological features of *C. gracilis* var. *chordalis*, since this name antedates the name "*gracilescens*" by three years. Nylander's specimens of f. *contorquescens*, according to Vainio (1894, p. 126), represent a somewhat aberrant form of *C. gracilis* η . *elongata*.

Apparently the only additional form which has been assigned in the literature to *C. ecmocyna* as a species is *f. foveata* E. Dahl, which was proposed as new in 1950 (p. 99). This form was based on specimens collected by the author at Ivigtut, Greenland, and is known only from the type-locality. Zahlbruckner, however, in the fourth volume of his catalogue (1927, p. 548), listed the following forms under *C. gracilis* var. *ecmocyna*: *f. nigriceps* (Nyl.) Zahlbr., *f. rostrata* (Ach.) Zahlbr., and *f. subdilacerata* Vainio. The first is obviously a misprint for *f. "nigripes."* The second, under which "*C. gracilis f. rostrata* Ach." is cited as a synonym, is presumably based on *Cenomyce ecmocyna* β . *rostrata* Ach. (1810, p. 550), at least in part. Vainio interpreted this as a synonym of *C. gracilis* η . *elongata*, and it therefore seems safe to include Zahlbruckner's *f. rostrata* under *C. ecmocyna* var. *macroceras*.

The third form was originally described by Vainio under the name *C. gracilis* **f. subdilacerata* (1894, p. 95) and was later cited by him as *C. gracilis* var. *elongata* *f. subdilacerata* (1897, p. 251). Both Merrill (1924, p. 25) and Sandstede (1931, p. 363), who recognized *f. subdilacerata*, included it without question under *C. gracilis* var. *elongata*, and Anders (1928, p. 99) was equally definite in including it under *C. elongata*. Under the circumstances it is perhaps wisest to leave it in this position.

The varieties *macroceras* and *nigripes* will provide for specimens of *C. ecmocyna* having the morphological features of *C. gracilis* var. *elongata* or of *C. gracilis* var. *chordalis*. Specimens with the features of var. *dilatata*, however, are still without a name. For such specimens the writer recommends the name "*intermedia*," derived from *C. elongata* *f. intermedia* Robbins (1931, p. 137). This form was based on specimens from Wyoming, and Dr. Blake, the collector, has kindly supplied a portion of the type-material. Although Robbins associated *f. intermedia* with *C. elongata*, the podetia form cups essentially like those of *C. gracilis* var. *dilatata*, and microchemical tests reveal the presence of atronorine.

CLADONIA ECMOCYNA var. MACROCERAS (Floerke) Ach. in Nylander, Middendorff's Reise in Siberien 4: LV. 1867. *Capitularia gracilis* γ . *Capitularia macroceras* Floerke, in part, Weber and Mohr's Beiträge zur Naturk. 2: 330. 1810. *Cenomyce ecmocyna* β . *C. rostrata* Ach., in part, Lich. Univ. 550. 1810. *Cenomyce ecmocyna* γ . *C. macroceras* Ach., in

part, Syn. Lich. 263. 1814. *Cladonia ecmocyna* f. *contorquescens* Nyl. in Norrlin, Notis. Sällsk. F. et Fl. Fennica Förhandl. **13**: 319. 1873. *C. gracilis* var. *ecmocyna* f. *rostrata* Zahlbr. Cat. Lich. Univ. **4**: 548. 1927.

Alaska: Etchepuk River, *Palmer*, 1923, No. 506, listed by Merrill (*Bryologist* **32**: 47. 1929), as *C. gracilis elongata*. **Quebec**: Frazier Island, Hudson Bay, *Gardner*, 1939, Nos. 93, 102, 103, and 105, listed by Gardner (*Mém. Soc. Bot. France* 1949: 93. 1950), as *C. gracilis* var. *elongata*; island at mouth of Kikkerteluk River, *Taylor*, 1944, No. 323; Mont Blanc, Matane Co., *Lepage*, 1942, No. 3510, listed by Lepage (*Natur. Canadien* **75**: 183. 1949); ten miles northeast of Cape Jones, *Lepage and Dutilly*, 1944, No. 6768. **Ontario**: twenty miles north of Lake River, James Bay, *Smith*, 1944, No. 67. **Manitoba**: Fort Churchill, *Gilett*, 1948, No. 1615. **Northwest Territories**: Leonard Island, Hobewan Sound, *Taylor*, 1944, Nos. 123, 317a, and 320. **Alberta**: Sulphur Mountain, near Banff, *Lamb*, 1951, No. 6195; Johnson Canyon, near Banff, *Lamb*, 1951, Nos. 6200 and 6206; Corral Creek, north of Lake Louise, *Lamb*, 1951, No. 6311; Redoubt Mountain, near Lake Louise, *Lamb*, 1951, No. 6314; Egypt Lake, *Lamb*, 1951, No. 6502. These stations are all in the Banff National Park. **British Columbia**: Yoho National Park, *Lamb*, 1951, No. 6373. **Maine**: summit of Mt. Katahdin, *Allard*, 1938, Nos. 5202 and 5204. **Colorado**: north slope of Twin Sisters Mountain, *Kiener*, 1930, Nos. 606, 607, and 619; vicinity of the University of Colorado camp, near Nederland, Boulder Co., *Miss Fulford*, 1936, No. 1024; near the Rocky Mountain Biological Station, Gothic, *Miss Fulford*, 1936, No. 1048; near Lake City, Hinsdale Co., *Darrow*, 1937, No. 1352; Long Lake, South St. Vrain, *Kiener*, 1937, No. 5241; Sandbeach Lake, Boulder Co., *Kiener*, 1937, Nos. 5603 and 9602; west slope, Trail Ridge, *Kiener*, 1938, No. 7153; Longs Peak, Larimer Co., *Kiener*, 1939, Nos. 8143, 8173, 9130, and 9237; Glacier Gorge, Larimer Co., *Kiener*, 1939, Nos. 9266, 9269, 9270, 9271, and 9273; Willow Creek Road, north of Granby, Grand Co., *Darrow*, 1947, Nos. 4106 and 4118. Most, if not all, of these stations are at high altitudes, 9,000–11,800 ft. **Wyoming**: Yellowstone National Park, *Blake*, 1927, five specimens without numbers, listed by Robbins (*RHODORA* **33**: 137. 1931), as *C. elongata* f. *laontera*; Medicine Bow, Carbon Co., *Manning*, 1935, No. 106; Yellowstone National Park, *Kiener*, 1936, Nos. 5943 and 5944. **Oregon**: near Clear Lake, Willamette Forest, *Sipe*, 1938 and 1939, Nos. 1037, 1045, and 1047; near Fish Lake, *Sipe*, 1939, No. 1028.

The specimens assigned to var. *macroceras* exhibit a considerable range of variability. In some cases the podetia, which are cupless or with narrow cups, are free from squamules or nearly so and agree in their morphological features with esquamulose specimens of *C. gracilis* var. *elongata*, such as those figured by Anders (1928, pl. 14, f. 1–3) under the name *C. elongata* var. *esquamosa*. In other cases the podetia are more or less squamulose, and this condition is found in much of the material from the

Rocky Mountains. Podetia of this type bear a striking resemblance to the podetia of *C. gracilis* var. *elongata* f. *laontera* (Del.) Arn., figured by Anders (1928, pl. 14, f. 5) under the name *C. elongata* var. *squamosa* f. *laontera*. In the more robust specimens of var. *macroceras* from North America the podetia are 2–3 mm. in diameter and attain a height of 6–8 cm.

CLADONIA ECMOCYNA var. **nigripes** (Nyl.) comb. nov. *C. ecmocyna* f. *nigripes* Nyl. in Norrlin, Notis. Sällsk. F. et Fl. Fennica Förhandl. **13**: 319. 1873. *C. ecmocyna* f. *gracilescens* Nyl. in Norrlin, Medd. Soc. F. et Fl. Fennica **1**: 13. 1876. *C. gracilis* var. *ecmocyna* f. *nigripes* ("nigriceps") Zahlb. Cat. Lich. Univ. **4**: 548. 1927.

Alaska: Etchepuk River, Palmer, 1923, No. 494, listed by Merrill (Bryologist **32**: 47. 1929), as *C. gracilis chordalis*; Peace River, Palmer, 1923, No. 623, listed by Merrill (l. c.), as *C. gracilis chordalis*; upper Buckland River, Palmer, 1924, No. 933; First Chance Creek, Palmer, 1924, No. 941; Cantwell, Palmer, 1926, No. 1454; between Palmer and Willow, Dutilly, Lepage and O'Neill, 1947, No. 22,181; Umiat, Scholander, 1948, no number; same locality, Llano, 1949, No. 534b; Kodiak Island, Llano, 1949, No. 1801b; Kenai Mountains, Lutz, 1949, No. 421. Most of the specimens of *C. ecmocyna* from Alaska are duplicates of specimens in the U. S. National Herbarium. **Quebec**: ten miles northeast of Cape Jones, Lepage and Dutilly, 1944, No. 6507; Manik Lake, Rogan River, Ungava, Lepage, 1950, No. 13,152. **Northwest Territories**: Christopher (Shell) Island, Polunin, 1946, No. 18,750. **Alberta**: Twin Cairns Mountain, Banff National Park, Lamb, 1951, No. 6500; "Lake Nipigon and Rocky Mountains," Macoun, 1885, distributed in Macoun's Canadian Lichens, No. 95, as *C. gracilis* var. *elongata* f. *chordalis*, station doubtful but perhaps in Alberta. **British Columbia**: Parson's Mountain, Vancouver Island, Macoun, 1893, distributed in Macoun's Canadian Lichens, No. 161, as *C. gracilis* var. *elongata* f. *macroceras*. **Colorado**: Willow Creek Pass, north of Granby, Grand Co., Darrow, 1947, No. 4117. **Wyoming**: Canyon Junction, Yellowstone National Park, Blake, 1927, no number, listed by Robbins (RHODORA **33**: 137. 1931), as *C. elongata* f. *ecmocyna*. **Washington**: Yakima Park, Mt. Rainier, Miss Howard, 1931, No. 600, listed by the collector (Bryologist **40**: 100. 1937), as *C. amaurocraea*. **Oregon**: Hardesty Mountain trail, Willamette Forest, Sipe, 1933, No. 809.

The specimens of var. *nigripes* show less variability than those of var. *macroceras*, and the podetia in the North American material are either entirely free from squamules or very sparingly squamulose toward the base. Most of the podetia are cupless and taper to sharp points, but occasional examples form narrow cups, which may give off marginal proliferations. The podetia rarely exceed 1 mm. in diameter or 5 cm. in height and are

therefore more slender and usually shorter than those of var. *macroceras*. Typical specimens are more or less pigmented with brown and agree, in their morphological features, with *C. gracilis* var. *chordalis* f. *amaura* Floerke, as illustrated by Anders (1928, pl. 13, f. 12).

CLADONIA ECMOCYNA var. **intermedia** (Robbins) comb. nov. *C. elongata* f. *intermedia* Robbins, RHODORA **33**: 137. 1931.

Manitoba: Fort Churchill, *Thomson*, 1950, No. 3418; Farnsworth Lake, Churchill, *Edmund*, 1950, No. 25,214. **Alberta:** Lake Agnes, near Lake Louise, Banff National Park, *Lamb*, 1951, No. 6277. **British Columbia:** Yoho National Park, *Lamb*, 1951, No. 6363. **Wyoming:** Canyon Junction, Yellowstone National Park, *Blake*, 1927, no number (type of *C. elongata* f. *intermedia*); Yellowstone National Park, *Blake*, 1927, no number, listed by Robbins (RHODORA **33**: 137. 1931), as *C. elongata* f. *ecmocyna*.

The robust podetia of var. *intermedia* broaden out gradually and form broad and shallow cups, which are mostly 5–8 mm. in width. Some are sterile but many bear brown apothecia, either sessile or shortly and irregularly stipitate. In rare instances one or two marginal proliferations are present. Aside from the cups the podetia are much like those of var. *macroceras* and may be more or less squamulose or free from squamules. The type-specimen of *C. elongata* f. *intermedia*, as illustrated by Robbins (1931, pl. 209, f. 1), is both squamulose and fertile. The figure of *C. ecmocyna* published by Anders (1928, pl. 14, f. 8) shows broad cups with marginal proliferations. In all probability the specimens figured represent var. *intermedia*, although not wholly in agreement with the North American specimens.

LITERATURE CITED

- ACHARIUS, E. 1810. *Lichenographia Universalis*. Göttingen.
 ANDERS, J. 1928. *Die Strauch- und Laubflechten Mitteleuropas*. Jena.
 ASAHINA, Y. 1943. Chemismus der *Cladonien* unter besonderer Berücksichtigung der japanischen Arten (Fortsetzung). *Jour. Jap. Bot.* **19**: 227–244.
 DAHL, E. 1950. Studies in the Macrolichen Flora of South West Greenland. *Meddel. om Grønland* **150**: 1–176.
 FRIES, TH. M. 1871. *Lichenographia Scandinavica*. Pars Prima. Upsala.
 MERRILL, G. K. 1924. Some new species of American *Cladoniae*. *The Bryologist* **27**: 21–26.
 NORRLIN, J. P. 1873. Öfversigt af Torneå (Muonio) och angränsande delar af Kemi Lappmarkens mossor och lafvar. *Notis. Sällsk. F. et Fl. Fennica Förhandl.* **13**: 271–349.
 ————. 1876. *Flora Kareliae Onegensis II*. (Lichenes.) *Medd. Soc. F. et Fl. Fennica* **1**: 1–46.

- NYLANDER, W. 1866. Lichenes Lapponiae orientalis. Notis. Sällsk. F. et Fl. Fennica Förhandl. **8**: 101–192. 1882. Although the title-page of Vol. 8 is dated 1882, Nylander's article was issued in 1866.
- . 1867. Lichenes Middendorffiani. Middendorff's Reise in den äussersten Norden und Osten Sibiriens **4**¹ (Anhang 6): LV-LVIII.
- ROBBINS, C. A. 1931. Cladonias collected by S. F. Blake in the Western United States. RHODORA **33**: 135–139.
- SANDSTEDTE, H. 1912. Die *Cladonien* des nordwestdeutschen Tieflandes und der deutschen Nordseeinseln. II. Abhandl. Naturw. Ver. Bremen **21**: 337–382.
- . 1922. Die *Cladonien* des nordwestdeutschen Tieflandes und der deutschen Nordseeinseln. III. Abhandl. Naturw. Ver. Bremen **25**: 80–243.
- . 1931. Die Gattung *Cladonia*. Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz **9**. Abt. 4²: 1–131.
- . 1938. Ergänzungen zur Wainio's "Monographia *Cladoniarum* universalis." Fedde's Repert. Spec. Nov. Regn. Veg. **103** (Beih.): 1–103.
- SCRIBA, L. 1913. *Cladonien* aus Korea. Hedwigia **53**: 173–178.
- VAINIO, E. 1894. Monographia *Cladoniarum* universalis. Pars Secunda. Acta Soc. F. et Fl. Fennica **10**: 1–498.
- . 1897. Monographia *Cladoniarum* universalis. Pars Tertia. Acta Soc. F. et Fl. Fennica **14**: 1–268.
- . 1922. Lichenographia fennica II. Acta Soc. F. et Fl. Fennica **53**: 1–340.
- ZAHLEBRUCKNER, A. 1927. Catalogus lichenum universalis **4**: 481–704.
- ZOPF, A. 1908. Beiträge zu einer chemischen Monographie der *Cladonien*. Ber. Deutsch. Bot. Gesell. **36**: 51–113.

PERLUSTRATIONES PLANTARUM ARCTICARUM IV:

'PARRY PLANTS' ADDED TO THE UNIVERSITY HERBARIA, OXFORD

NICHOLAS POLUNIN

THAT the various Herbaria belonging to Oxford University, rich as they were in ancient collections and type specimens, lacked special 'sets' of plants from Sir W. E. Parry's arctic expeditions, had long been a source of regret—especially in view of the number and excellence of such sets that were known to be deposited in other institutions in Europe and North America—for the botanical collections made during Parry's expeditions were practically the first of real scientific value to be brought back from the American Arctic. To be sure, the Fielding Herbarium (Oxford's main, general herbarium) contained a useful total of specimens from Parry's first two expeditions, apparently collected in a very few instances by the great man himself, and more often by his surgeons John Edwards and Alexander Fisher, or by his lieutenants Beechey, Hoppner, or J. C. Ross (all of whom, and also